

Hawaii Renewable Energy Development Venture (HREDV) Program

Assessment of Technology Readiness and Applicability

1.0: Selection of Technologies for Assessment

The Hawaii Renewable Energy Development Venture (HREDV) program has been established to administer federal grants to support the development, demonstration, deployment, and commercialization of renewable energy and related enabling technologies. These grants are intended to assist the State of Hawaii in moving towards energy self-sufficiency and the reduction of dependency on foreign oil and state-wide greenhouse gas emissions. The HREDV program focus is on nearer term technologies that are appropriate for Hawaii.

The Pacific International Center for High Technology Research (PICHTR), the organization leading the HREDV project, has requested the technical assistance of the University of Hawaii's Hawaii Natural Energy Institute (HNEI) to provide assessments of key aspects of relevant selected energy technologies to ensure that proposed projects considered for grant funding are appropriately evaluated for consistency with the program's focus and goals, especially in view of funding limitations.

Accordingly, to select technologies for assessment, HNEI conducted an initial screening of renewable energy and enabling technology categories using expert opinion on the status of technology commercial readiness and appropriateness for Hawaii. The "Technology Selection Criteria and Metrics" report, previously prepared for PICHTR to assist with evaluation of proposals for grant funding, also was utilized in the screening process to down-select to technology areas that hold promise for near-term deployment and commercialization in Hawaii. A diagram illustrating a matrix of potential renewable energy sources and enabling technologies identified is provided in Appendix A of this document.

As a result, the following technology areas have been selected for a "technology assessment". The assessment includes a technology overview and assessments of readiness for commercialization and appropriateness to Hawaii. These assessments are intended to be used by HREDV program management, coupled with the selection metrics and criteria, as tools for project evaluation. The assessments are comprised of the following:

1. Solar energy systems: photovoltaic and solar thermal (two assessments).
2. Small scale wind turbines.
3. Biomass: energy crops, conversion technologies, and algae oil production & extraction (three assessments).
4. Grid Modernization: smart grids, energy storage, and demand side management (three assessments).
5. Transportation technologies for electric vehicles.
6. Geothermal: Engineered Geothermal Systems (EGS) and low grade geothermal heat (two assessments).

7. Ocean: Wave and OTEC (two assessments).
8. Water resources: small pumped hydro, and water/energy integration. (two assessments).

Following HREDV's experience with the initial proposal selection process, the list may be re-evaluated to determine if some technologies on the list should be excluded and/or some technologies previously excluded should be added.

2.0: Template for Assessments

The assessments will be prepared by HNEI to provide HREDV program management with "snapshots" of each technology area including a brief overview of a technology or family of technologies, as appropriate, the status of its commercial readiness, and its appropriateness to Hawaii. These assessments are not intended to be excessively thorough or rigorous, but are simply intended to be sufficient for the reader to understand the importance of this technology area to Hawaii and to determine whether the particular technology area should be considered for near-term funding.

The following are specific questions for framing the assessments for each technology area. They include, but may not be limited to:

Overview:

- Brief description of the technology. What is the role of the technology in a transportation or power generation system based on renewable energy?

Status of Commercial Readiness:

- What is its level of commercial readiness?
- For those technologies that are not commercial but are in the latter phases of demonstration:
 - What are the issues associated with successfully demonstrating the technology in Hawaii?
 - What are the issues in bringing emerging technologies to market/deployment?
- For technologies that are still in development, are there candidates that might have significant upside potential if provided with more resources?

Appropriateness to Hawaii

- Which specific elements of the technology, if any, are most appropriate for use in Hawaii?
 - How will the technology support additional renewable energy penetration into Hawaii's energy system?
 - Is this a technology that is a key to success in other areas?

Considerations related to specific technologies and/or resources

For renewable energy resource technologies, availability of the resource in the state may be a significant assessment factor. For bioenergy technologies, for example, additional questions may include:

- What is the probability that the resource will be available in sufficient amounts to contribute materially to Hawaii's use of renewable fuels?
- What is the probability that the resource will be locally available in the nearer term?

3.0: Additional Project Evaluation Considerations

In addition to the technology assessments and selection criteria/metrics proposed by HNEI as project evaluation tools, HREDV must consider the characteristics of specific project proposals. For example, the following factors are particularly relevant to bioenergy systems projects:

1. Potential for market share in the state. This relates to the availability of feedstock.
2. Potential for developing an economically robust industry that could exist without subsidies.
3. Availability of resources for the development of a given feedstock: water, land, labor.
4. Potential impacts on the environment and society which would result from large scale implementation of a technology.
5. For any given technology or feedstock, the current maturity of the systems that are being developed.
 - a. Is it research? For example, algal production may hold promise, but is currently viewed as a research endeavor and would not be eligible for funding by this project.
 - b. What is the maturity of the technology being developed? A mature technology is ethanol from sugar cane. While Brazil has shown that this is an economic activity, we need to examine the local situation to determine if project funding is warranted to accelerate technology deployment specific to Hawaii.
 - c. Where would the resource come from? For many bio-fuels under development, tropical oils for bio-diesel hold great promise. However, none of these oils are currently obtained from state resources. Is funding for resource development leading to a new indigenous industry appropriate?
 - d. Who else is funding these efforts? For some bio-refinery work, USDOE has spent a considerable amount of money. Should we take advantage of this expenditure, while also deploying specific technologies for Hawaii?

The maturity of the particular technology or resource would also be an important factor in determining the type of policy instruments that the state either has or may develop that can support state-specific deployment of these technologies. For bioenergy projects, state policy and incentives may impact:

1. Development of indigenous biomass feedstock that is currently not under large-scale production (tropical oils)
2. Utilization of existing biomass feedstock through the further development of conversion technology (cellulosic ethanol)
3. Development of agri-business industry to take advantage of existing or future feedstock consistent with Hawaii's location (ethanol, bio-diesel, or other crops for electricity production)

4. Future development of agricultural lands and consistency with land, water, and labor resources within the state.

In total, project evaluation tools that will support project goals need to take into account the relative maturity of the technology and resource, the potential for substantive reduction in oil dependence, and the related impacts on the environment, economy, and society. Where possible, these tools should also make note of state government policies and mechanisms that can support the development of local industry for creating jobs and reducing oil dependence.

Attachment A

Matrix of Renewable Energy Sources and Enabling Technologies

